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Fuglede's spectral set conjecture

A set $\Omega \subset \mathbb{R}^d$ is called *spectral* if the space $L^2(\Omega)$ has an orthogonal basis of exponential functions. Back in the 1970's Fuglede conjectured that spectral sets could be characterized geometrically by their ability to tile the space by translations. Although since then the subject has been intensively studied, the precise connection between spectrality and tiling by translations is still a mystery. In the talk I will survey the subject and discuss some recent results, joint with Nir Lev, where we focus on the conjecture for convex polytopes.